

REMARKS

This Amendment is in response to the Office Action dated March 27, 2007. In the Office Action, claims 22, 25, 32 and 33 were objected to, claim 19 was rejected under 35 USC §112, claims 1, 5, 9-17, 18-20, 21-26 and 27-31 were rejected under 35 USC §102, and claims 6, 32 and 33 were rejected under 35 USC §103. By this Amendment, claims 1, 5, 10, 15 and 16 9 are amended, and claims 2-4, 7-9, 14, 18, 19, 22, 23, 26, 27 and 31-33 are canceled. Currently pending claims 1, 5, 6, 10-13, 15-17, 20, 21, 24, 25 and 28-30 are believed allowable, with claims 1, 5, 6, 10, 15 and 16 being independent claims.

CLAIM OBJECTIONS:

Claims 22 and 26 were objected because they were dependent on the canceled claim 7. OA, pg. 2. By this amendment, claims 22 and 26 have been canceled. The Applicants thank the Examiner for pointing out this error.

Claims 32 and 33 were objected because the phrase "the output value" lacked antecedent basis. OA, pg. 2. Claims 32 and 33 are canceled, with their subject matter have been incorporated into claims 5 and 15 respectively. The errors in the limitations have thus been corrected in claims 5 and 15. By this amendment, the phrase "the output value" has been changed to "an output value". Additionally, the phrase "the pixels enclosed within the window" has been changed to "pixels enclosed within the window". The Applicants thank the Examiner for pointing out this error.

CLAIM REJECTIONS UNDER 35 USC §112:

Claim 19 was rejected under 35 USC §102 as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. OA, pg. 2. The rejection is moot because claim 19 has been canceled.

CLAIM REJECTIONS UNDER 35 USC §102:

Claims 1, 5, 15, 20, 21, 24, 25 and 29 were rejected under 35 USC §102 as being anticipated by U.S. Patent No. 5,875,268 issued to Miyake ("Miyake"). OA, pg. 11.

Claims 9, 18, 19, 23, 27 and 31 were rejected under 35 USC §102 as being anticipated by U.S. Patent No. 5,093,870 issued to Watanabe ("Watanabe"). OA, pg. 23.

Claims 10-14, 16, 17, 22, 26, 28 and 30 were rejected under 35 USC §102 as being anticipated by U.S. Patent No. 6,535,651 issued to Aoyama et al. ("Aoyama"). OA, pg. 25.

To anticipate a claim under 35 USC §102, a reference must teach every element of the claim. MPEP 2131.

Claim 5:

Claim 5 has been amended to include the following limitations:
". . . wherein the rank order processing includes: raster-scanning a window enclosing a target pixel and one or more of its neighboring pixels; and computing an output value of the target pixel by performing an averaging operation on pixels enclosed within the window." These limitations are identical to those previously introduced by claim 32 except for minor changes noted above under Claim Objections. The addition of the new claim limitations does not add new matter to the application. Support for the new claim limitations is believed to exist within the specification. As one example: "Specifically, the rank order processing is performed by raster-scanning a window, enclosed by a broken line 21 in FIG. 3A, in the direction indicated by an arrow 22, and the pixel positions are adjusted in accordance with the even numbers of the pixels in the window. In the area enclosed by the broken line 21, four windows are defined by a pixel 23 at the second row and the second column, a pre-scan pixel (second row and first column) and the pixels along the preceding line (first row and first column and second column), and the median operation, for example, is performed for the four windows to determine the output value for the pixel 23 on the second row in the second column." App., para. 0063.

Claim 32 was rejected under 35 USC §103 as obvious over U.S. Patent No. 5,875,268 to Miyake ("Miyake") in view of U.S. Patent No. 6,020,863 to Taylor ("Taylor"). Because claim 5 now incorporates the limitations previously introduced by claim 32, the Applicants shall address the rejection of claim 32 as it now applies to claim 5.

To establish a *prima facie* case of obviousness, there must be some suggestion or motivation to modify the reference or to combine reference teachings. MPEP 2143.

In rejecting claim 32, the Examiner alleges:

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify Miyake's teaching of installing the invention with an output apparatus that includes "buffers" in col. 22, line 42 with Taylor's fig. 2, num. 200, because Taylor's teaching of fig. 2, num. 108 includes an "most important" in relation to "display data interpolation" in col. 4, lines 45, 46 in col. 4, line 52 feature that "controls the raster of pixel data from frame buffer 110" in col. 4, lines 49, 50 that is used for displaying on a screen. Thus, Taylor provides a teaching that displays that is more important than interpolation, because without the teaching, the results of interpolation cannot be seen. OA, pg. 37-38.

Interpolation is employed by the present invention to expand an image so that the same image is displayed using a greater number of pixels. However, Taylor discloses an apparatus for displaying images on conventional television sets. The first sentence of the abstract of Taylor recites, "A display control system (200) for transferring video and graphical data processed in a first processing device (201) having a dedicated display screen to a second processing device (202) for display on the screen (152) of a conventional television set (150)." Conventional television sets known in the art typically have a lower resolution (e.g., a lesser number of pixels) than computer display screens known in the art. It is therefore implausible that one would employ linear interpolation to expand an image displayed by Taylor's image display apparatus. For this reason, one skilled in the art would not be motivated to combine the method of linear interpolation disclosed by Miyake with the image display apparatus disclosed by Taylor.

Additionally, the Applicants respectfully submit that the words "most important" do not apply to "display data interpolation". The passage of Taylor including the words, "Most importantly", recites:

Generally, display controller 108 controls screen refresh, executes a limited number of graphics functions, such as line draw, polygon fill, color space conversion, display data

interpolation and zooming, and video streaming, and handles other ministerial chores such as power management. Most importantly, display controller 108 controls the raster of pixel data from frame buffer 110 to the PC display screen during screen refresh and interfaces CPU 102 and frame buffer 110 during display data update. In some embodiments of the prior art, video data may be directly input into display controller 108 (connection not shown). Taylor, col. 4, ln. 43-54 (emphasis added).

It is evident from the cited passage that the words "[m]ost importantly" does not apply to "display data interpolation." Instead, "[m]ost importantly" applies to the raster of pixel data from a frame buffer to a PC display screen. To the contrary, Taylor mentions display data interpolation in a sentence describing general features of display controllers known in the art. The sentence disclosing display data interpolation begins with the word "Generally". Furthermore, the cited passage discloses features of the prior art as opposed to features specific to the teachings of Taylor. This is evident from the fact that the cited passage relates to Fig. 1 of Taylor, which is clearly labeled as "PRIOR ART". No other passage of Taylor discusses any form of interpolation. It is thus evident that Taylor does not express an appreciation of display data interpolation.

For at least these reasons, the Applicants respectfully submit that claim 5 is not obvious in view of Miyake and Taylor, and earnestly solicit allowance of the claim.

Claim 15:

Claim 15 has been amended to include the following limitations:
 ". . . wherein the rank order processing includes: raster-scanning a window enclosing a target pixel and one or more of its neighboring pixels; and computing an output value of the target pixel by performing an averaging operation on pixels enclosed within the window." These limitations are identical to those previously introduced by claim 33 except for minor changes noted above under Claim Objections. Additionally, these limitations are substantially similar to the limitations previously in claim 32 which have been added to claim 5. Therefore, for the same reasons discussed in claim 5, the addition of the new claim limitations does not add any additional

information to the specification and support for the new claim limitations is believed to exist within the specification.

In rejecting claim 33, the Examiner alleges the same argument as presented for claim 32. OA, pg. 38. For the same reasons discussed regarding claim 5, the limitations added to claim 15 are not obvious in view of Miyake and Taylor.

For at least these reasons, the Applicants respectfully submit that claim 15 is not obvious in view of Miyake and Taylor, and earnestly solicit allowance of the claim.

Claim 1:

Claim 1 has been amended to include the following limitations: "... wherein the neighboring pixels comprise a first neighboring pixel and a second neighboring pixel, and wherein determining an interpolation direction comprises: calculating a left oblique difference using the target pixel and the first neighboring pixel; calculating a right oblique difference using the target pixel and the second neighboring pixel; determining the left oblique direction to be the interpolation direction when the left oblique difference is smaller than a threshold value and when the right oblique difference is greater than a threshold value; and determining the right oblique direction to be the interpolation direction when the left oblique difference is greater than a threshold value and when the right oblique difference is smaller than a threshold value" These limitations further limit claim 1 to require that determining an interpolation direction includes at least the method steps specified in the limitations.

The addition of the new claim limitations does not introduce new matter to the application. Support for the new claim limitations is believed to exist within the specification. Fig. 4, described in para. 0076-0080, depicts a flowchart of an exemplary interpolation direction determination process. Specifically, "... calculating a left oblique difference . . ." and "... calculating a right oblique difference . . ." are supported by the following passage of the specification:

First, the neighboring pixels at an inverse projected point of a target expansion point are obtained from the original image data input unit 11 (step 201), and differences for the horizontal and

the vertical, and the right and the left oblique directions are calculated (step 202). Specifically, when inverse projection is performed from the target coordinates obtained by expansion to the original coordinates, four peripheral pixels are employed to calculate differences in the horizontal and the vertical, and the right and the left oblique directions. . . . App., para. 0077.

Furthermore, ". . . determining the left oblique direction to be the interpolation direction . . ." and ". . . determining the right oblique direction to be the interpolation direction . . ." are supported by another passage of the specification:

When the horizontal or the vertical difference is equal to or smaller than the threshold value, a check is performed to determine whether the difference in the left oblique direction is equal to or smaller than the threshold value (step 204). And if the difference in the left oblique direction is equal to or smaller than the threshold value, a check is performed to determine whether the difference in the right oblique direction is equal to or smaller than the threshold value (step 205). Then, should the difference be equal to or smaller than the threshold value, i.e., when the difference in each of the two oblique directions is equal to or smaller than the threshold value, the vertical and horizontal directions are determined to be interpolation directions (step 210). Whereas if at step 205 the difference in the right oblique direction is greater than the threshold value, the left oblique direction is determined to be the interpolation direction (step 211). If at step 204 the left oblique direction is found to be greater than the threshold value, a check is performed to determine whether the difference in the right oblique direction is equal to or smaller than the threshold value (step 206). In this case, if the difference in the right oblique direction is equal to or smaller than the threshold value, the right oblique direction is determined to be the interpolation direction (step 212). But if at step 206 the difference in the right oblique direction is found to be greater than the threshold value, then the vertical and horizontal directions are determined to be interpolation directions (step 213). App., para. 0078 (emphasis added.)

Turning to the cited references, Miyake discloses linear interpolation and edge creation as follows:

FIGS. 4A, 4B illustrate linear interpolation and the manner in which edge creation is performed. This is illustrated along a direction in one dimension in order to simplify the description.

The circle marks indicate pixel values of sampling points in terms of low resolution, and the x marks indicate pixel values of interpolated points interpolated between the above-mentioned pixel values. The point indicated by the circle mark situated at the central position is the pixel of interest.

As shown in FIG. 4A, MAX, MIN values are detected from the adjacent pixels and the threshold value TH is calculated in accordance with the above-mentioned equation. If we assume that an enlarged pixel block centered on the pixel of interest is composed of five pixels, then, as shown in FIG. 4B, four pixels will be greater than TH and therefore will take on the MAX value, and one pixel will be less than TH and will take on the MIN value.

FIGS. 5A, 5B illustrate an example in which edge information is created. Assume here that the pixel of interest of the low-resolution information has a pixel value of "80" placed at the center, as shown in FIG. 5A. One pixel of this pixel of interest is interpolated by a factor of N vertically and M horizontally, as shown in FIG. 5B, and an edge is created by performing binarization at a MAX value of "200", a MIN value of "20" and a binarization threshold value $(200+20)/2=110$ within the window.

By virtue of the edge creation processing described above, it is possible for pixels which touch an edge portion in a low-resolution image to create a smooth edge, namely high-resolution information, in the resolution direction within the enlarged block. Miyake, col. 5, ln. 59 to col. 6, ln. 22.

The Applicants respectfully submit that the cited passage contains no teaching or suggestion of determining an interpolation direction by performing at least the method steps required by claim 1. Furthermore, nowhere else in Miyake is found any teaching or suggestion of determining an interpolation direction by performing at least the method steps required by claim 1. Additionally, while Aoyama also appears to disclose a method for determining an interpolation direction at col. 25, ln. 27 to col. 27, ln. 38, this method likewise fails to disclose the specific method steps required by claim 1. Furthermore, nowhere else in Aoyama is found any teaching or suggestion of determining an interpolation direction by performing at least the method steps required by claim 1.

For at least these reasons, the Applicants respectfully submit that claim 1 is not anticipated by Miyake and earnestly solicit allowance of the claim.

Claims 20 and 24:

Claims 20 and 24 are dependent on and further limit claim 1. Since claim 1 is believed allowable, claims 20 and 24 are also believed allowable for at least the same reasons as claim 1.

Claims 21 and 25:

Claims 21 and 25 are dependent on and further limit claim 5. Since claim 5 is believed allowable, claims 21 and 25 are also believed allowable for at least the same reasons as claim 5.

Claim 29:

Claim 29 is dependent on and further limits claim 15. Since claim 15 is believed allowable, claim 29 is also believed allowable for at least the same reasons as claim 15.

Claim 10:

Claim 10 has been amended to include the following limitations:
". . . wherein the neighboring pixels comprise a first neighboring pixel and a second neighboring pixel, and wherein detecting an oblique direction comprises: calculating a left oblique difference using the target pixel and the first neighboring pixel; calculating a right oblique difference using the target pixel and the second neighboring pixel; detecting the left oblique direction to be the oblique direction when the left oblique difference is smaller than a threshold value and when the right oblique difference is greater than a threshold value; and detecting the right oblique direction to be the oblique direction when the left oblique difference is greater than a threshold value and when the right oblique difference is smaller than a threshold value . . ."

The addition of the new claim limitations does not add any new matter to the application. Furthermore, the new claim limitations are substantially similar to those added to claim 1. Thus, for the same reasons as listed for claim 1, support for the new claim limitations is believed to exist within the specification. Similarly, for the same reasons as listed for claim 1, both Miyake and Aoyama fail to teach the new claim limitations.

On page 18 of the response to the previous Office Action, the Applicants submitted that "Aoyama is devoid of any teaching . . . of a

directional correlation reductions means." The Examiner disagreed with this assertion because "Aoyama [sic] obtains a 'smooth image' in col. 4, lines 55,56 just the same as the claimed correlation reduction that obtains a 'smooth shape' in page 18, line 17 of the specification." OA, pg. 9-10. The paragraph including the passage cited by the Examiner recites:

An interpolating operation method for an image signal in accordance with the present invention is characterized by changing the interpolating operation process, depending upon whether an interpolation point is located at an image edge portion or at a flat image density portion, such that an interpolating operation process capable of obtaining a sharp image free from any step-like pattern may be applied with respect to the image edge portion, and such that an interpolating operation process capable of obtaining a smooth image or an interpolating operation process enabling sharpness to be adjusted may be applied with respect to the flat portion. Aoyama, col. 4, ln. 48-59.

Claim 10 recites, ". . . vertical and horizontal directional correlation reduction means for reducing correlation of the obtained image in the vertical and horizontal directions" Thus, claim 10 requires reducing correlation of an obtained image. The Applicants respectfully submit that the cited passage contains no teaching or suggestion of reducing correlation of an obtained image. While Aoyama discloses ". . . obtaining a smooth image . . .", neither the cited passage nor any other passage of Aoyama discloses that a smooth image is obtained by reducing the correlation of an image. Furthermore, smoothing is not equivalent to correlation reduction. "Smoothing" is a broad term which encompasses correlation reduction but which also encompasses any of a wide variety of other techniques for increasing the smoothness of an image.

Additionally, the cited passage of Aoyama discloses ". . . an interpolating operation process which is capable of obtaining a smooth image" Thus, Aoyama teaches away from smoothing via correlation reduction because Aoyama teaches that smoothing is instead achieved via an interpolating operation.

For at least these reasons, the Applicants respectfully submit that claim 10 is not anticipated by Aoyama and earnestly solicit allowance of the claim.

Claims 11-13, 28 and 30:

Claims 11-13, 28 and 30 are dependent on and further limit claim 10. Since claim 10 is believed allowable, claims 11-13, 28 and 30 are also believed allowable for at least the same reasons as claim 10.

Claim 16:

Claim 16 has been amended to include the following limitations:
". . . wherein the neighboring pixels comprise a first neighboring pixel and a second neighboring pixel, and wherein determining an interpolation direction comprises: calculating a left oblique difference using the target pixel and the first neighboring pixel; calculating a right oblique difference using the target pixel and the second neighboring pixel; determining the left oblique direction to be the interpolation direction when the left oblique difference is smaller than a threshold value and when the right oblique difference is greater than a threshold value; and determining the right oblique direction to be the interpolation direction when the left oblique difference is greater than a threshold value and when the right oblique difference is smaller than a threshold value . . ."

The addition of the new claim limitations does not add new matter to the application. Furthermore, the new claim limitations are substantially similar to those added to claim 1. Thus, for the same reasons as listed for claim 1, support for the new claim limitations is believed to exist within the specification. Similarly, for the same reasons as listed for claim 1, both Miyake and Aoyama fail to teach the new claim limitations.

Additionally, two claim limitations have been removed from claim 16:
". . . for calculating directional differences between said target pixel and said neighboring pixels for right oblique and left oblique directions . . ." and ". . . based on said directional differences . . ." It is noted that the new limitations added to claim 16 are more specific forms of the removed claim limitations. Thus, removing the claim limitations does not substantially modify the scope of claim 16 in light of the fact that more specific forms of the removed limitations have been added.

Claim 17:

Claim 17 is dependent on and further limits claim 16. Since claim 16 is believed allowable, claim 17 is also believed allowable for at least the same reasons as claim 16.

CLAIM REJECTIONS UNDER 35 USC §103:

Claim 6 was rejected under 35 USC §103 as obvious over U.S. Patent No. 5,917,963 to Miyake ("Miyake '963") in view of U.S. Patent No. 6,285,798 to Lee et al. ("Lee").

Claims 32 and 33 were rejected under 35 USC §103 as obvious over U.S. Patent No. 5,875,268 to Miyake ("Miyake") in view of U.S. Patent No. 6,020,863 to Taylor ("Taylor").

A *prima facie* case for obviousness can only be made if the combined reference documents teach or suggest all the claim limitations. MPEP 2143.

Claim 6:

Claim 6 recites, in part, ". . . determining, for said expanded image, whether the contrast in said original image data can be maintained at a predetermined level . . ." Thus, claim 6 requires determining whether the contrast in original image data can be maintained at a predetermined level. It is emphasized that this is different than specifying that the contrast in the original image data can be maintained at a predetermined level.

In rejecting claim 6, the Examiner conceded that Miyake '963, col. 7, ln. 6-17 ". . . fails to state that the contrast in an image can be maintained at a predetermined level for the associated 'First Embodiment' in col. 5, line 25." OA, pg. 10. The Examiner proceeds to allege:

However in the "Fourth Embodiment" in col. 11, line 58, Miyake teaches that in fig. 19, label "4filt(k)-3th" corresponds to "h(k)" in col. 14, line 13 that has an "increased contrast" in col. 14, lines 13,14 that requires a "limitation" in col. 14, line 14 as indicated by the MIN and MAX values of fig. 19. Thus, the limitation using predetermined values of MAX and MIN corresponds to the claimed maintained at a predetermined value. OA, pg. 10.

The preceding argument alleges that Miyake '963 teaches maintaining the contrast of an image at a predefined level. Assuming *arguendo* that this is the case, Miyake '963 nonetheless fails to teach determining whether the contrast in original image data can be maintained at a predetermined level.

The passage cited by the Examiner recites:

FIG. 19 shows edge generation in a case where $a=4$. Herein, since the transition line $h(k)$ has an increased contrast, it is necessary to establish limitation for a density value. In FIG. 19, the aforementioned MAX and MIN values are set as the limitation values. The portion indicated by a bold line is the newly generated high resolution data of a pixel-block of interest. Miyake '963, col. 14, ln, 12-18.

The Applicants respectfully submit that the cited passage fails to teach or suggest maintaining contrast at a predetermined value. The "limitation" cited by the Examiner is applied to a density value as opposed to the contrast per se. Furthermore, even if setting the limitations values to the MAX and MIN values causes the contrast to be decreased, it is not evident why doing so inherently causes the contrast to equal a predetermined level.

For at least these reasons, the Applicants respectfully submit that claim 6 is not obvious in view of Miyake and Lee and earnestly solicit allowance of the claim.

Claims 32 and 33:

Claims 32 and 33 have been cancelled. However, the limitations of claims 32 and 33 have been added to claims 5 and 15 respectively. Therefore, the argument presented by the Examiner was addressed above regarding claims 5 and 15.

CONCLUSION

In view of the forgoing remarks, it is respectfully submitted that this case is now in condition for allowance and such action is respectfully requested. If any points remain at issue that the Examiner feels could best be resolved by a telephone interview, the Examiner is urged to contact the attorney below.

No fee is believed due with this Amendment, however, should a fee be required please charge Deposit Account 50-0510. Should any extensions of time be required, please consider this a petition thereof and charge Deposit Account 50-0510 the required fee.

Respectfully submitted,



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